PERSPECTIVE

Renewable Energy Systems: Viable Options for Contingency Operations

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The strategic importance of the United States having an unimpeded source of energy is becoming ever more crucial. The significance of energy and the need for greater energy responsibility by the US have been identified in several State-of-the-Union Addresses. President Bush's 2006 State-of-the-Union Address stated that "America is addicted to oil" and encouraged federal agencies to lead the way in developing more reliable alternative energy programs. In July 2006, Major General Richard Zilmer, Chief of Multi-National Forces West, identified a crucial need for "a self-sustainable energy solution" available for use by US forces in Iraq. Use of renewable energy systems is one way to help decrease dependency on fossil fuels and offer Warfighters alternative sources of energy to accomplish their mission. This article explores the institutional impediments that prevent the Army from increasing its use of renewable energy systems in Contingency Operations and makes recommendations to overcome those barriers in order to enhance use of renewable energy, thereby becoming less dependent on foreign oil.

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Concerns of having an unimpeded source of energy continue to have significant strategic importance in an unpredictable oil market. Oil addiction, as identified by President Bush in his 2006 State-of-the-Union Address,[1] generates significant military and foreign policy issues, as well as domestic economic considerations. The economic instability of oil prices directly affects military budgets, with the potential to influence military operations and national security.[2] With approximately two-thirds of the US Department of Defense's budget required to pay for foreign oil and oil use continually growing, the military must be mindful of factors influencing its supply. Because the US military is dependent on oil, oil impacts the military and, therefore, the nation.

Over the past two years, the price of oil has fluctuated from $30 to $70 per barrel, with prices holding toward the higher end of this range. Because of the US dependence on fossil fuel, disruption in the supply of oil can have a dramatic impact. During Hurricane Katrina, approximately 25% of the US crude oil production was interrupted, resulting in gasoline prices jumping from over $2.00 per gallon to just under $4.00 per gallon.[3] Given the US military's ever increasing use of foreign oil, should US petroleum imports have a greater reduction than that of Hurricane Katrina or last for a longer period of time, the consequences could be staggering and would inevitably affect military operations.

While performing Contingency Operations,[4] the US military uses approximately 1.3 million gallons of fuel per day in Iraq alone. The importance of securing the US oil supply becomes clear. The US military has an unquenchable thirst for fuel to power vehicles, communications equipment, and heating and cooling systems. One could raise the question, Does the US military need a million-plus gallons of fuel daily for operations in Iraq, or could the US military use alternative energy producing systems to provide the power needed?

Although fossil fuel is used to power the services listed above, fuel to power some of these systems could come from sources that are not fossil fuel based. Renewable energy systems (RES) (power from wind turbines and photovoltaic [solar] panels) are viable energy producing options that could reliably provide energy during Contingency Operations. Although today's RES technology is not sufficient to power tactical vehicles, RES technology can provide power for other military needs currently receiving fossil fuel power. RES offer Commanders[5] viable sources of energy that can effectively augment, and in some cases replace, current fossil fuel generator systems. This benefit could be of significant strategic and tactical importance when operating in austere environments with asymmetrical, irregular warfare or to supply energy to a Forward Operating Base.

The logistical burden of providing fuel to generators alone is staggering. A 60-kW generator consumes fuel at a rate of 4.5 gallons per hour for an annual total of well over 39,000 gallons.[6] If the price for fuel was only $2.15 per gallon, this single fossil fuel generator would cost in excess of $84,000 annually to operate. Furthermore, there is an additional cost to maintain and repair these generators. Depending on the size and energy demands of the Forward Operating Base, it is conceivable that a single Forward Operating Base could require approximately 5,400 gallons of fuel per 24 hours (just under $5 million annually) to power communication systems, lighting, heating, air conditioning, and other soldier-comfort needs. Augmenting power gener-

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ation services with RES could greatly decrease this fuel need and reduce the logistical burden caused by fueling current generator sets. RES could be used to power computers, power communication systems and radios, heat water, run medical equipment, recharge batteries, and generate power for a wide variety of morale, welfare, and recreation items for soldiers.

Tactically, RES offer numerous advantages. RES decrease the need for fossil fuel, add power, decrease the logistical footprint, and are dependable, durable, and reliable. The use of lighter RES equipment requires fewer transportation assets. Through their quiet operation, RES enhance the unit's stealth with noise reduction and loss of heat signature. RES use can become a force multiplier by enhancing maneuverability, flexibility, mobility, interoperability, and agility. Communication lines are strengthened by decreasing the vulnerability, number, and frequency of convoys, thus increasing soldier safety.[7]

Strategically, the use of RES strengthens national energy security and provides the Warfighter with energy necessary for Contingency Operations. RES use supports the "Army Posture Statement" and the "Army Strategy for the Environment" while saving money and conserving precious resources. If leaders are to be innovative, agile, versatile, and multi-skilled, adding RES to their arsenal will be a crucial step to meet the National Security Strategy and foster transformation throughout all levels of the US Army.

Impediments to Implementation

With all the identified benefits of using RES, it is difficult to understand why these systems are not used more often. The US Army continues to field equipment, some of which was developed decades ago (including energy systems), that directly dictates current energy requirements, technology, and supply sources through fuel demands and system efficiencies or inefficiencies. In reality, impediments to the use of RES in Contingency Operations are vast and varied. Six key impediments could affect the Army's increased use of RES.[8] They include:

1. Leadership Issues
2. Doctrine/Policy Issues
3. Institutional Perceptions
4. Acquisition Process
5. Renewable Energy Expertise
6. Financial Considerations

Leadership issues regarding the use of RES exist throughout various levels of the Army, from senior leaders to lower enlisted soldiers. Simply put, the Army has failed to educate its leaders about RES. Many Commanders lack the confidence, vision, and insight to effectively employ RES or understand how RES can impact the force structure. Furthermore, most junior soldiers are unaware of the various RES currently available that could be employed to improve and maintain operational effectiveness while decreasing the need for fossil based fuel. In addition, there is a definite lack of reported need for RES by senior leaders, Major Combatant Commanders, and leaders in line units. An extensive literature review resulted in only one Combatant Commander, Major General Zilmer, identifying a need for RES.[9] Unfortunately, there appears to be limited interest or command emphasis toward implementation of RES in Contingency Operations.

There is little reference in Army doctrine and policy regarding RES use during Contingency Operations. What is mentioned appears outdated. Limited, if any, information is found in Army regulations, policies and procedures, technical manuals, supply and re-supply procedures, operations, or mission-essential task list requirements to use RES. Continued use of outdated doctrinal belief by Army leadership regarding traditional energy sources without serious consideration to the benefits of RES significantly limits options for efficient means of generating, converting, and utilizing energy.

No military service schools make reference to or incorporate use of RES in their various curriculums. General instruction at Basic Combat Training, Advanced Individual Training, Non-Commissioned Officer Development Schools, Basic Officer Leaders' Course, and Captains' Career Course, as well as Officer and Non-Commissioned Officer advanced education schools, fails to address RES. Institutional beliefs and stereotypes can only be changed with the infusion of new information on RES and their ability to enhance the mission. Current preconceived mindsets, established biases, and cultural issues about the Army's "energy institution" must be overcome. Unrealistic thinking leads to the belief that there is and always will be an unlimited source of fossil fuel available for energy, wherever and whenever needed. What needs to be understood is that this energy comes at a price: the cost in dollars to purchase fuel, equipment to haul it, and vulnerability of soldiers assigned to convoys bringing fuel to run generators.[10]

The Army acquisition process is a thorough system of checks and balances that ensures items meet a specific standard before being fielded. This inevitably becomes a fairly lengthy process, typically taking up to 10 years or longer to complete. The acquisition process addresses design, development, and production of new systems, including modifications to existing systems that may require redesign of the system or subsystem. Time from onset of the project to fielding of equipment varies greatly depending on multiple factors, including research and development, technology, or complexity of the system. RES are tested by manufacturers as part of their development process, yet still require extensive review and analysis through the acquisition process, delaying RES availability for soldier use. The Stryker vehicle is an excellent example of how a system can move quickly through a lengthy acquisition process, greatly decreasing the time it normally takes for equipment to be fielded. Expediting the acquisition process without compromising program integrity, yet maintaining the efficiency of the RES, can be an effective solution to assigning a federal stock number to RES. Once RES have a federal stock number, they can be ordered, obtained, and maintained through supply channels.

RES expertise in the Army is limited in terms of operation, maintenance, and re-

pair. With the continued limited use of RES by the Army, it will be extremely difficult, if not impossible, for the Army to develop experts in this area. There is skepticism by some that the industry is ready and able to produce sufficient quantity and quality of deployable RES in a timely manner to meet military specifications. Having specifications clearly identified in military contracts will help overcome this skepticism. RES expertise (similar to medical, linguistic, and electronic specialties) is most likely to increase as the Army increases its use of RES.

Finally, there can be a fairly significant initial financial investment for RES. Although RES typically pay for themselves in a few years, payback can vary according to the configuration of the individual system, when and where the system is deployed, the frequency and duration of system use, and the overall efficiency of a particular RES. Even with RES being initially more expensive than the purchase of a typical fuel generator, the payoff in the long run makes the investment worthwhile. At a cost ranging from hundreds to hundreds of thousands of dollars for various RES, this investment is significantly more cost effective than the millions of dollars currently spent on fuel and equipment to run traditional generators for energy. Unfortunately, the legislative process gives mixed messages on the importance of using RES, as funding for their purchase and use is continually cut.[11] As the demand for RES increases, the cost for these systems will in turn decrease. If the Army were to become a major purchaser of RES, the cost for RES would certainly decrease due to the purchasing power of the Army. Increased demand for RES by the Army would significantly leverage manufacturers to meet military demands and specifications, influence improvements in technology, increase availability of RES, promote greater system efficiency, and, thereby, increase the Army's use of RES.

Recommendations

Leadership

Although the use of RES in Contingency Operations is a new concept for the US Army and Department of Defense, the need for energy is not. Education and training on RES at all levels must be emphasized and will be crucial to overcome preconceived ideas about what RES can and cannot do. The current mindset and culture regarding the use of renewable energy, or the lack thereof, must change. The strategic importance of secure energy cannot be overstated and is a leadership challenge of the future. RES need integration at the strategic and operational level, and continued research and development on RES is a necessity that must be a priority for Army sustainability.

Establishing and implementing an RES Command may be beneficial to address and influence policy and funding issues. Key Army leaders, as well as the joint operation community, have a responsibility to make appropriate changes in doctrine, organization, leadership, training and education, personnel systems, and unit equipment to address various solutions regarding the importance of RES use. Greater understanding of RES will drive Commanders and leaders at all levels to incorporate RES into operational planning at the earliest stages in order to enhance mission execution.

Doctrine/Policy

Changes in doctrine and updates in policy regarding RES are overdue. New concept plans must be developed with emphasis on changing current military doctrine to include use of RES. Research and development will continue to drive strategies for better implementation of RES. In turn, RES will require a federal stock number and table of organizational equipment authorization for incorporation into the military supply system.

Institutional Perception

Skill sets of the soldier will need to include the use of RES at the earliest opportunity. Basic Combat Training, Advanced Individual Training, Warrior Leadership Course, Basic Officer Leaders' Course, Captains' Career Course, and Senior Officer and Enlisted Service Schools are examples of opportunities for soldier education on RES. In addition, Common Task Training, Field Training Exercise, and Joint Training events must include planning for and use of RES. With an atypical, asymmetrical battle space, it will become crucial for leaders to be future and system thinkers yet understand the importance of taking every opportunity to use RES to their fullest extents.

If the Army fights as it trains, then it must train with RES to ensure proper application of these systems, gain soldier knowledge and competence in their use, and maintain ongoing soldier proficiency. Commanders including RES as part of the unit's mission-essential task list further emphasize the importance of their roles to the soldier and the mission. Clear lines of responsibility and requirements for RES use must be openly articulated up and down the chain of command to achieve the greatest success in incorporating RES into Contingency Operation missions.

Acquisition Process

In order to bring RES to the Warfighter earlier, improvement must occur within the acquisition process. Because most of the RES research and development occurs by the manufacturer, an expeditious process should be in place to acknowledge the scientific testing and work already completed. It may be advantageous to expedite the acquisition process to field test RES in Contingency Operation settings similar to the course of action completed with the Stryker vehicles. This could reduce or eliminate additional RES research and development needed by the Army, resulting in expediting the acquisition process to more quickly move RES to the field.

Expertise

It may be advantageous to change the perception of RES from an "environmental benefit" to enhancing War fight capacity. Although RES minimize pollution and are environmentally friendly, their primary function is to provide Commanders with a viable, dependable energy source with a significant reduction in the need for fossil fuel. This can help to remove many associated fossil fuel burdens (cost, transportation, storage, soldier exposure

to improvised explosive device attack during convoys, etc.). RES enhance combat readiness and effectiveness by decreasing logistical support, thereby augmenting the Commander's Warfighting capability. Furthermore, using RES enhances force protection posture for Commanders and increases soldier safety. RES can be attractive for future recruiting. As RES are implemented, the need for RES specialists grows. RES skill sets are marketable to the private sector as well.

Funding

Appropriate funding for the purchase of RES, along with further research and development, is crucial. Allocating $23 million for RES and having this cut to $3 million can only be described as unacceptable. If the US Army is to make a serious effort to decrease its dependence on fossil fuel, it must budget for and procure RES as aggressively as it does other soldier systems. Without this commitment, little will change. Soldiers will continue to be in harm's way with convoy duty, millions of gallons of fossil fuel will be used to power generators, and billions of dollars will be spent on less efficient energy systems.

Sustainability

Initial planning for use of RES with forward base camp operations will be a vital component of Contingency Operations, as Commanders can expect logistical lines to be strained at times and host nation support to be limited. RES can greatly impact sustainability needs, including heat and electricity for tents, hot water for showers and mess needs, and decreased environmental degradation through stewardship and responsibility. Use of RES offers solutions to Commanders for decreasing fuel needs, while enhancing the capability of their units.

Conclusion

The need for dependable, secure energy is a national security issue. It is very clear that the US Army will most certainly require energy as a vital resource to accomplish its mission. As the world oil supply continues to diminish, oil prices continually rise, and the demand for energy grows at an ever increasing rate, energy (or the lack thereof) will undoubtedly influence many aspects of military operations. RES are not a one-size-fits-all option intended to be the ultimate replacement of current energy sources. Rather, RES can effectively augment current energy systems and are viable, efficient energy systems that can help provide the Warfighter with abundant energy.

RES use can enhance maneuverability, mobility, survivability, and sustainability. Use of RES will improve stealth, yet decrease detection, fuel storage, transportation needs, and waste. Lighter systems equate to fewer assets required to transport energy producing systems. The logistical footprint is significantly decreased due to a lower fuel demand and communication lines become more secure. RES can increase energy efficiency, promote energy security, improve soldier safety, and reduce dependence on fossil fuels. Use of RES helps Commanders focus their attentions on mission priorities rather than on the transportation of fuel or exposure of soldiers to hazards from improvised explosive device attacks. RES have the unique ability to offer Commanders important characteristics that fossil fuels lack, at a price fossil fuels can no longer provide.

Establishing and implementing an integrated, cross-functional approach to provide recommendations for the right training, education, and direction in the use of RES is paramount to the Army. Changes in current and future doctrine, along with policy emphasis on employment of RES, are overdue. RES systems not only increase soldier safety through reduction of the logistical footprint, they also serve to save equipment, save money, help preserve natural resources, demonstrate environmental stewardship, and greatly reduce the Army's reliance on fossil fuels. The old proverb is true: "If we continue to do what we have always done, we will continue to get what we have always gotten"—dependence on foreign oil when that dependence is no longer sustainable.

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Notes

1. State-of-the-Union Address by the President, United States Capitol, Washington, DC, January 31, 2006. President Bush acknowledged that the United States is addicted to oil, along with a need for alternative energy sources. Breakthroughs and new technologies will help the United States replace more than 75% of its oil imported from the Middle East by the year 2025.

2. "Al Qaeda Faction Urges Oil Attacks," 2007, *Los Angeles Times*, available at http://ebird.afis.mil/ebfiles/e20070215489580.html, accessed February 15.

3. J. Szczesny, 2006, "Gas Prices Spike after Katrina," available at http://www.thecarconnection.com, accessed November 21.

4. For the purpose of this article, the term Contingency Operations, or "CONOPS," will equate as follows: *CONOPS*—Large-scale peace operations (or elements thereof) conducted by a combination of military forces and nonmilitary organizations that combine one or more of the elements of peace operations, which include one or more elements of other types of operations such as foreign humanitarian assistance, nation assistance, support to insurgency, or support to counterinsurgency. (Taken from Joint Pub-

lication 3-57, Joint Doctrine for Civil-Military Operations, February 8, 2001.)

5. For the purpose of this article, the term "Commander" will equate as follows: *Commanders*—Those individuals who have a direct impact on decisions regarding military operations, policy, and doctrine that include but are not limited to senior leaders, commissioned officers, noncommissioned officers, junior soldiers, and policy makers and planners where their decision and/or action results in planning for and equipping the Warfighter.

6. J. Cross and P. Richard, 2007, *Alternative Energy Strategies: Joint Stand Renewable Energy Mobile Power Generating Sources*, briefing slides with scripted commentary, the Pentagon, March 27.

7. L. Samuelson, 2007, *Advanced Solar Energy Solutions for the Warfighter Workshop*, briefing slides and scripted commentary, US Army Natick Soldier Center (NSC), Massachusetts, November 17; D. Muchow, 2007, *Renewable Energy Solutions for the Army*, briefing slides and scripted commentary, the Pentagon, March 27.

8. G. D. Kuntz, 2007, "Use of Renewable Energy Systems in Contingency Operations," Civilian Research Project, US Army War College, Carlisle Barracks, PA, May.

9. R. Bishnoi, 2006, "Renewable Energy Systems Wanted in Iraq," *Military.Com*, available at http://www.military.com/features/0,15240,109512,00.html, accessed August 11.

10. B. Bender, 2006, "Roadside Bombs Kill Troops at Highest Rate of Iraq War," *Boston Globe*, available at http://ebird.afis.mil/ebfiles/e20061217474565.html, accessed December 18.

11. "Energy Efficiency and Renewable Energy Legislation in the 109th Congress," 2006, available at http://www.theorator.com/bills109/hr4897.html.

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